Physics 375 Syllabus
Fall 2013 - Sections 101/104 (Paglione)

PHYS 375 Experimental Physics III: **Electromagnetic Waves, Optics and Modern Physics**. Third course in the three-semester introductory sequence. Methods and rationale of experimental physics. Experiments chosen from the areas of electromagnetic waves, optics and modern physics. In keeping with efforts to improve the department curriculum, this course is evolving into a hybrid Lecture/Laboratory optics course. It will nominally consist of lectures on topics in optics, and a series of six labs. **This is a three-credit course (four hours per week).**

Course Web Site: http://www.physics.umd.edu/courses/Phys375/index.html

ELMS Web Site: http://www.elms.umd.edu (uploading work)

Prerequisite: Physics 273 and Physics 276

Laboratory Location - Room **3202** Physics Building

Meeting Times:
Lecture: Monday 2:00 pm - 2:50 pm **(all sections)**
101 Lab: Monday 3:00 pm - 5:50 pm
104 Lab: Thursday 3:00 pm - 5:50 pm

Instructor: Prof. Johnpierre Paglione
Office: Room 1367 Physics Building (CNAM annex)
email: paglione@umd.edu
Phone: 301-405-7115

Office Hours: please make an appointment by email.

Teaching Assistant: TBD

Overview: PHYS375 is a three (3) credit course that meets four hours a week. In a new configuration, it will include a substantial lecture component, so that students learn optics in a coherent fashion. The primary laboratory objective consists of learning physics through experimental investigation. Topics to be covered include electromagnetic waves, geometrical optics, polarization, interference and interferometers, diffraction, and atomic spectra. There will be six experiments, each lasting for two class periods, as well as lectures. This course will allow you to develop practical laboratory skills including experimental design and experimental uncertainty inherent in all measurement. You will be required to submit lab reports for each experiment completed, along with homework submitted on those weeks when a lab report is not due.

Required Text and Other Materials:

- ***Introduction to Optics*** (3rd Ed.), F. L. Pedrotti, L. S. Pedrotti, L. M. Pedrotti. ISBN: 0131499335.
- ***Lab Notebook*** (for example: Computation Notebook, 11 3/4" x 9 1/4", 4x4 Quad., approx. 75 sheets, bound, numbered pages that are not perforated for tear-out)
- ***Lab Instruction Sheets***: these will be posted on the course website for download.

Recommended:
- *Optics by* Eugene Hecht, 4th Edition, ISBN 0-8053-8566-5.
- "*An Introduction to Error Analysis: The Study of Uncertainties in Physical Measurement*", John R. Taylor (University Science Books, 1997, ISBN 0-935702-75-X).

- "*Data Reduction and Error Analysis for the Physical Sciences*", Phillip R. Bevington and D. Keith Robinson (McGraw Hill, Inc., 2003, ISBN 0-07-247227-8).
- other books on optics and modern physics, including your Phys 171/272/273 texts.

Preliminary Schedule:

WEEK	DATE	LECTURE#	LAB#	LAB	SUBMIT
1	2/5-Sep	[NO CLASS]	--	[NO LAB]	
2	9/12-Sep	1	0	Introduction / Matlab	---
3	16/19-Sep	2	1	Reflection and Refraction	Asmt 1
4	23/26-Sep	3	1	Reflection and Refraction	Asmt 2
5	30-Sep/3-Oct	4	2	Geometrical Optics	Lab 1 (summary)
6	7/10-Oct	5	2	Geometrical Optics	Asmt 3
7	14/17-Oct	6	3	Polarization of Light	Lab 2 (full report)
8	21/24-Oct	7	3	Polarization of Light	Asmt 4
9	28/31-Oct	8	4	Michelson Interferometer	Lab 3 (summary)
10	4/7-Nov	9	4	Michelson Interferometer	Asmt 5
11	11/14-Nov	10	5	Diffraction of Light	Lab 4 (full report)
12	18/21-Nov	11	5	Diffraction of Light	Asmt 6
13	25/28-Nov	12	--	[HOLIDAY/MAKE-UP WEEK]	Lab 5 (summary)
14	2/5-Dec	[NO CLASS]	6	Atomic Spectra	---
15	9-Dec	FINAL EXAM	6	Atomic Spectra	Lab 6 (summary)

Grading:

70 % Lab Reports, Performance and Attendance
20 % Assignments
10 % Final Exam

NOTE: *All labs must be completed to pass the course – no exceptions!*

Lectures: The lectures are a required component of this class. This is an excellent opportunity to learn optics and to make connections to your other courses (electromagnetism, quantum mechanics, etc.) and deepen your understanding of physics. Important topics directly related to the lab will be covered in lecture. **Attendance** will be taken via weekly hard copy submissions of assignments and lab reports during class. ***Note that no student shall be allowed into the lab unless they have participated in that week's lecture!***

Computers: Developing a working knowledge of computers in the context of physics problem solving is an important skill. You will accumulate data with a computer-based data acquisition system. We will provide some elementary MATLAB code for use in data collection and analysis.

Lab Reports: There are six experiments in this course, and you are required to submit a written report of your results for each experiment consisting of either an extended **Full Report** (~15-20 pages) or a short **Summary Report** (i.e. ~5 pages) as explained below. All reports will be submitted both electronically using the ELMS system and **a hard copy will be due at the start of each lecture following the completion of the lab** (see schedule). Reports should be submitted

as a **DOC or PDF file**, complete with embedded data and figures, and hard copies must be printed using color ink and appear as professional scientific documents.

----- SEE REPORT WRITING GUIDE and EXAMPLE REPORT on ELMS -----

- **FULL REPORTS** (labs 2 and 4) consist of two main parts – the record of what you did in the lab, including notes on the apparatus, how you acquired data, and the raw data. The second part is data analysis, including plots, extraction of the actual quantities to be measured, and uncertainty analysis. It should end with a discussion of ways to improve the measurement. This may be a different form for a lab report than what you are used to – rather than having you repeat the material we already know (what the problem is, what the equipment is,…) you should focus on what you did and what conclusions you drew. *This type of report serves as a full record of your experiment and results, and should be directed to a scientific audience not familiar with the lab.*

  Every Full Report must have:
  - title page, with name, title, abstract etc.
  - introductory material, explaining the theory required to understand the reason for the experiment and the analysis used to arrive at conclusions.
  - record of experiment (description of actual experimental setup **you** used)
    - schematics and diagrams of equipment and experimental setup
    - notes on experimental procedures, attempts, success/failures, etc.
    - raw data (provide units!)
    - comments about experimental conditions/ discoveries
    - referrals to appendices, tables, electronic files etc with raw data
  - experimental results, including raw data plots, tables etc., as well as summary plots.
  - data analysis
    - plots of analyzed data
    - formulae used to extract measured quantities
    - uncertainty analysis/propagation, sources of error, methods of error assignment
  - discussion of results and conclusions
    - final results with uncertainties
    - comparisons to expected/known/previous results and other sources
    - identification of predominant source of uncertainty
    - discussion of ways to improve measurement and other possible measurements

- **SUMMARY REPORTS** (labs 1, 3, 5 and 6) are abbreviated versions of a full report, consisting of a summary of the procedures used, a record of the data required for analysis and discussion about analysis, results and conclusions. *This report serves as a record of your lab performance and results, and should reflect that.*

  Every Summary Report must have:
  - title page, with name, title, abstract etc.
  - brief summary of experimental setup and procedures
  - summary plots of experimental results and data analysis
  - data analysis summary and brief discussion of uncertainty assignment, analysis, etc.
  - discussion of results, including values, comparisons, uncertainty, improvements, conclusions, etc.

All lab report grading will follow this rubric:

Laboratory skill	**20 %**
Organization and logic of report	**20 %**
Data analysis	**50 %**
Discussion of results, uncertainties and methods of improvement	**10 %**
TOTAL	**100 %**

Late Reports, Missed Labs and Homework: **Lab reports submitted after the deadline will be receive 50% penalty for being up to 1 week late, and 100% penalty for >1 week late -- *No Exceptions!!!!*** If you should miss any lab for any reason, contact the instructor as soon as possible to make an arrangement for makeup. **Missing any of the six labs without a valid reason that is *PRE-APPROVED* by the instructor will result in course failure - no exceptions.** Homework material is designed to complement the lecture and laboratory segments of the course. Homework is assigned every two weeks, with due dates that fall in between the lab report due dates. **Late homework will not be accepted and will receive a zero grade**. You have at least a week to turn in all assignments, and the assignment due date schedule is given to you on the first day, so there are ZERO EXCUSES!

Tips for Doing Well:

- Read the lab instructions carefully **before** you go to the lab and attempt an experiment.
- During class, keep a neat, well-organized and **complete record** in your lab notebook of the experiment including diagrams of measurement configurations actually used to obtain data, your results, and the analysis used to obtain the results.
- When something in the lab isn't making sense or isn't working raise your hand and discuss with your instructor - **do not hesitate to ask** even the most trivial questions if you are not sure!
- Do not leave class unless you have finished your data analysis and discussed your results with your instructor or TA.
- Do the assigned homework and submit it for grading **on time**.

Academic Integrity - The University of Maryland, College Park has a nationally recognized Code of Academic Integrity, administered by the Student Honor Council. This Code sets standards for academic integrity at Maryland for all undergraduate students. As a student, you are responsible for upholding the highest standards of academic integrity in this course and should be aware of the consequences of cheating, fabrication, facilitation, and plagiarism. For more information on the Code of Academic Integrity or the Student Honor Council, please visit http://www.studenthonorcouncil.umd.edu/whatis.html.

In case of Bad weather: Winter in the Washington Metro area can bring large snowstorms that make travel dangerous. Should this happen and the University is closed as a result during a scheduled lab, class will be cancelled, and we will most likely reschedule the lab for the following week. Closing is announced over local radio and TV as well as on the University's homepage.